FCC Tutorial: Wireless Phones and Hearing Aid Usability

Cellular Telecommunications & Internet Association

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Introduction

- Purpose of tutorial
- Topics the tutorial will cover
  - Hearing Aid Compatibility vs. Interference
  - Hearing Aids
  - Wireline vs. Wireless Phones
  - Hearing Aid Compatibility
  - Interference
  - Possible Solutions to Usability Problems

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What is the goal?

Usability - Any consumer who wants to use a wireless phone should be able to use one.

Reaching the Goal

To reach the goal of usability several important concepts must be recognized:

- Hearing Aid Compatibility (HAC) and interference are different issues
- Requiring internal coupling (HAC) will not solve interference problems
- Hearing aid interference is the root problem and is not specific to wireless phones
- The wireless industry wants to participate in a solution but the solution cannot rest on the wireless industry alone

HAC in a Wireline Phone

- Wireline phones use electro-dynamic speakers that are designed to radiate a low-level magnetic field that can be picked up by a T-coil in a hearing aid equipped with a T-coil
- Because the phone's transmissions are carried by wire, as opposed to RF energy, and because a wireline phone does not generate extraneous electrical or magnetic fields, there is no interference from a wireline phone

Obstacles: HAC and Interference

Hearing Aid Compatibility (HAC) – 47 CFR 68.4(a)(3) – A telephone is hearing aid compatible if it provides internal means for effective use with hearing aids that are designed to be compatible with telephones which meet established technical standards for hearing aid compatibility.

Obstacles: HAC and Interference

The technical standards are set forth in 47 CFR 68.316 and require handsets to present a uniform magnetic field intensity to which hearing aids can "couple."

Obstacles: HAC and Interference

Interference - The effect of unwanted energy due to one or a combination of emissions, radiation, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.

National Communications System Technology & Standards Division Dictionary

Wireline vs. Wireless Phones

Wireline phones

- Transmission signal carried by wires
- Do not produce any extraneous electric or magnetic fields that could cause interference

Wireline vs. Wireless Phones

Wireless phones

- Transmission signal carried by radiofrequency (RF) energy
- Any device in the near-field of the phone could pick up any electric or magnetic fields from the phone

Qiang Xu
Audio/Acoustic Engineer

Nokia Mobile Phones

Hearing Aids

Hearing Loss Types

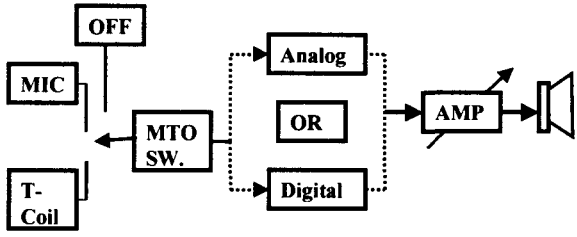
- Conductive: predictable, loss uniform across freq.
- Sensorineural: not-predictable, loss is freq. dependent. Need pre-fitting. Difficulty in acoustic noisy environment

Hearing aids work by:

- Picking up sound through a microphone
- Processing and amplifying the specific sounds the wearer needs
- Delivering the processed sound directly into the wearer's ear canal thru a speaker

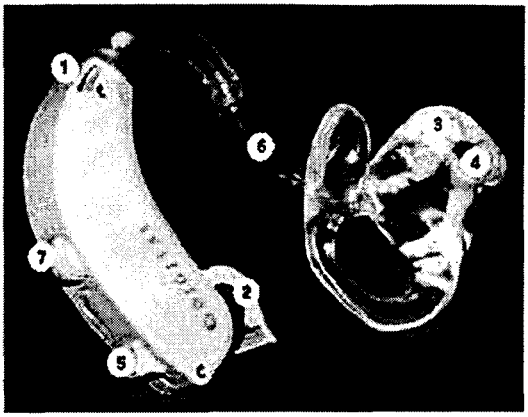
Hearing Aids

Hearing Aid diagram



Hearing Aids

- Behind-The-Ear Type Hearing Aid



1. Mic input port
2. Battery compartment
5. MTO (Mic, T-coil, Off) switch
6. Sound tube of speaker
7. Volume control
* Mic and T-coil are inside

The Earmold contains
3. Tubing
4. Ventilation

Hearing Aids

Telecoil or T-coil:

- Mic suffers from acoustic noise, T-coils can provide inductive coupling
- A small coiled wire designed to receive a low level magnetic signal from an electrical transmitting source (proximity)
- Inductive coupling avoids acoustic noise, but can still suffer from electrical forms of interference
- Are found in only about 20% of hearing aids

Al Lucas
Vice President and Director
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Motorola

Hearing Aid Compatibility

HAC can:

- Benefit hearing aid wearers who have hearing aids with T-coils and who do not experience interference when using a wireless phone
- Provide inductive coupling only to the 20% of hearing aids that have T-coils
- Be found today in loopsets, other inductive coupling accessory devices and handsets currently on the market

Hearing Aid Compatibility

HAC cannot:

- Fix the problem of interference
- Be retrofitted into phones already on the market

Hearing Aid Compatibility

Difficulties in providing internal coupling within wireless phones:

- Manufacturers design and build phones on global platforms that cannot be easily or quickly modified
- The addition of components in phones to provide coupling capability will require significant modifications of phones
- HAC standard is designed for wireline phones; use of this standard for wireless phones will not result in the desired outcome

Interference

Air interface standards' interaction with hearing aids:

Analog – continuous sine wave transmission

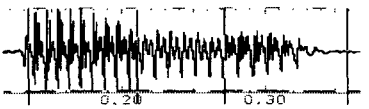
Digital – multiple individual pulses of information sent out at different rates depending on technology

Interference

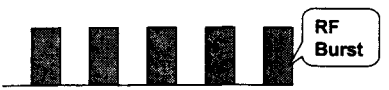
- TDMA family produces different types of interference depending on the particular technology – TDMA, GSM, or iDEN
- CDMA produces a unique type of interference based on the more dynamic frame rate and system power control

Hearing Aids

Electrical speech signal and interference



Speech Audio Signal
Low frequency



Typical digital RF Burst in high freq.
But with low freq envelope

Analog RF Energy in high freq.
But no low freq envelope; not audible

Interference

Wireless phones are:

- Designed to meet the technical standards of their technology (TDMA, GSM, CDMA, iDEN)
- Licensed by the FCC for the frequency band in which they transmit and for the power levels at which they transmit
- Must meet other tolerances specified by FCC

Interference

- "Fixing" wireless phones is not the solution to achieving usability
- Hearing aids can be made more immune so that they will not be affected by the many sources of RF in today's RF rich environment

Steve Coston
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Sony Ericsson

Industry Challenges

Modification of wireless phones for relief from interference affects more than just the phone:

- New Industry Standards for transmit/receive bands
  - Requires product development, test, and implementation
- Standards must meet regulations, carrier requirements, market viability, and globalization
- Will have implications for wireless networks

Modification of hearing aids for relief from interference is limited to the hearing aid model:

- Immunization of HA devices
  - Proven technology
  - Customizable per individuals needs

Consumer Options

Consumers have choices in the marketplace:

- Purchase immunized hearing aids
- Return hearing aids to manufacturers for increased immunity
- Selection of Accessory options:
  - T-coil accessory devices: Loopsets, Magnetic Coupling
  - Bluetooth accessories:
    - being explored for use in phones and hearing aids

Hearing Aid Solutions

- Increase hearing aid immunity
- Inform consumers of options in the market place
- Label hearing aids with immunity limits
- Inform consumers to support exchange and hearing aid upgrade options
- Customize solutions at Audiologist
  - Hearing aid manufacturers can test hearing aids to wireless field immunity levels to judge immunity

Other Industry Approaches

- Many devices are addressing RF interference issues by increasing immunity
- Transportation and Specialized Consumer Equipment are addressing RF interference issues

Development of a Measurement Method

Standard: ANSI C63.19 Standard

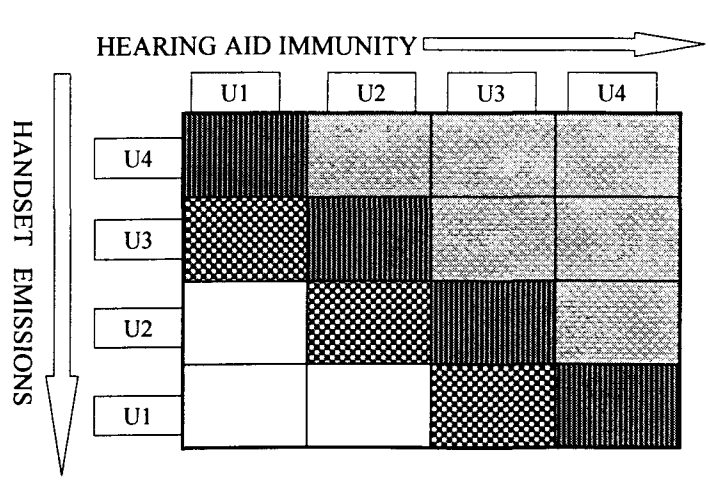
Standard developed following HA Summit in 1996

Purpose: To provide a tool to consumers to determine if a given phone and hearing aid combination can be expected to work well together

ANSI C63.19 Standard

- Created open dialog
  - HA manufacturers, wireless manufacturers, audiologists, FCC, FDA, and consumer groups
- The standard is designed to:
  - Provide consistent testing protocols for HA devices' immunity and mobile phones RF emission
  - Provide marks for classifying respective levels

ANSI C63.19 Standard



Key:

excellent good usable

ANSI C63.19 Standard

Additional benefits of standard:

- Development of a better understanding of interference issues
- Provide a baseline for products and devices
- Innovation of patents, test methods, theoretical levels of acceptance for RF and immunity

Status of ANSI C63.19

- Requires implementation by both wireless phone and hearing aid manufacturers
- Standard has not been "real world" tested

Ron Barnes
Director for External & Industry Relations

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International solutions

Europe and Australia – worked to resolve interference by increasing immunity in hearing aids

Australia – "It was confirmed that the interference mechanism is intimately associated with the essential nature of the mobile telephone emissions and is not an incidental by-product which might for example be solved by improved shielding of the telephones."

Interference To Hearing Aids by the Digital Mobile Telephone System, GSM; NAL Report No. 131, May, 1995

Education efforts

Wireless industry is prepared and willing provide education and information to:

- Consumers
- Wireless industry customer care, sales, and marketing personnel
- Hearing aid industry
- Audiologists/hearing specialists

Education efforts

In addition:

- Hearing aid industry should provide education and information to its customers and hearing professionals
- Audiologists/hearing specialists should provide consumers with information on using wireless phones with hearing aids
- FDA should provide consumers with information on hearing aid immunity

Conclusion

The wireless industry wants to participate in a solution, but the solution cannot rest on the wireless industry alone

Several important concepts:

- Interference and hearing aid compatibility are different issues
- Requiring internal coupling (HAC) will only address 20% of hearing aids (those with T-coils), it will not solve interference problems
- Hearing aid interference is the root problem and is not specific to wireless phones

Conclusion

- Hearing aids are designed for an individual's unique hearing loss; a solution that may work with one hearing aid may not work with another
- Imposing HAC or interference mitigation on wireless phones would affect the basic functionality of wireless handsets and networks

Conclusion

There are possible solutions:

- Australia and Europe offer effective models to resolve the interference problem
- Improvements in hearing aid design and immunity
- Consumers have choice in wireless phones, hearing aids and accessory devices
- Evolution of new wireless technologies (Bluetooth) offer promising options for both phones and hearing aids

Conclusion

- ANSI C63.19 standard can be a selection tool for finding the best phone and hearing aid combination, but much work remains to validate its use
- Commitment to provide better information and education about options to consumers, wireless industry customer sales and service personnel, audiologists and hearing specialists, and hearing aid industry